Privatization and decentralization of a public service:
Solid Waste Management in Kathmandu

Submission:
Thesis Final draft

Leah Meisterlin – Thesis Adviser
Caroline Bauer – Thesis Reader

Submitted by:
Suprima Bhele
May 08, 2019

Table of contents:

1) Abstract

Solid Waste Management (SWM) system in Kathmandu, Nepal was looked over by Kathmandu Metropolitan City (KMC). The three stages of SWM systems: collection, transportation, and disposal were all under its purview. Once, the waste was out of people's personal property; then the waste would be the property of the city. With the gap in the amount of waste generation and the amount of waste that KMC was treating, there was a rise of privatization in the SWM system which led to the decentralization of SWM systems.

The primary objectives of this study are:

- to examine the effects and impacts of decentralization in the SWM systems in Kathmandu on the city, the people and the systems themselves,
- to evaluate the drivers of SWM system operations, and
- to analyze the efficiency of any SWM system and its operation in Kathmandu.

With the qualitative approach of systematic observation and analysis through interviews of key players in the multiple systems, this study found that SWM in Kathmandu is seldom collaborative. There is instead an added financial expense on the locals for their desire of a clean neighborhood. Furthermore, findings revealed that there is a lack of vision and contingency plans for KMC's system and a lack of regulation for multiple private sector operations. This study concludes with recommendations for SWM systems and practices and the implications for planning research in SWM.

2) Acknowledgements

Firstly, I would like to thank my adviser, Professor Leah Meisterlin, for her continuous guidance, dedication, insight, and supportive feedback throughout the entire research process. I would also like to express my gratitude to my reader, Caroline Bauer for her thoughtful advice and directions.

My time at Columbia GSAPP was vital to my understanding of mechanisms and topics that are included in this study. A big thank you all my professors and my colleagues for their guidance, moral support, and directions.

A huge thank you to all who made this thesis possible. I am very thankful for this opportunity that introduced me to people who are passionate in their profession and move every day to make their city a better place. This process has been an incredibly rewarding experience and was a great reminder to why I am studying Urban Planning, as I prepare to graduate.

3) Background and Research Questions:

3.1 Background

Kathmandu that was once a thriving capital with its beautiful architecture, history of culture, with a clean, ornamental cityscape is now earning the title as "garbage capital" (The Hindustan Times, 2009). Kathmandu is not only the capital of Nepal but also a hub for many activities such as economic, transportation, educational. KMC has been important economically, administratively, and politically for hundreds of years. By being the center of all such activities, Kathmandu is no exception to the effects of rapid and uncontrolled urbanization (Asian Development Bank, 2015). During the past 25 years (1989–2014), the KMC has experienced tremendous growth that is expected to continue through 2030. The current urban development process is in a critical stage in which urban and fringe frontier areas will create unprecedented stress on land resources that will be manifested in river and forest ecosystems and other environmentally sensitive areas. With the continuous steep increase of urban population in Kathmandu, solid waste management is one of the many areas that is challenged. Amongst the various steps of waste management, KMC had its own system in place for the collection, transportation and disposal of waste. The inability of the city to accommodate all the waste produced gave rise to the private sector in the SWM system.

Solid waste generation in Kathmandu was estimated to be 1091 m^3/d (245 tons/day) and 1155 m^3/d (260 tons/day) for the years 2005 and 2006, respectively (Alam et al., 2008). Production of waste is natural but what causes the problem is the management status of the production. This city's waste management system, especially concerning the siting of

landfills, has been a challenge for over two decades. The legal structure of the associated authorities regarding environmental impact assessments are fledgling and lack key components (Dangi et al., 2015). Besides, there is also a high level of public dissatisfaction due to lack of public engagements. Public hearings get conducted with political representatives rather than onsite (Dangi et al., 2015). Autocratic procedures of landfill site selection also aid to the public discontent (Dangi et al., 2015).

The waste collection in Kathmandu has expanded from being under the municipality's jurisdiction to being handled by the private sector as well (Alam et al., 2008). The private sector serves in forms of non-governmental organizations, partnerships or even community organizations. The non-government solid waste management organizations collected about 17% of generated waste in 2000, which went up to 27% in 2003 (KMC, 2004). The generation of solid waste is also increasing rapidly with the growing population (Alam et al., 2008). The challenge begins when the demand for maintenance is beyond the management. In addition to the increase in demand, the built environment of Kathmandu is also a challenge. The number of narrow streets in the city leads to struggles in taking pickup trucks as well as difficulty in placing community bins (Alam et al., 2008).

There are provisions of equipment such as tractors, handcarts, and tricycles, that better cater to the narrow pathways (Table 1). Different solid waste management systems incorporate different equipment for their waste collection process as the need varies with area they serve varies. The waste collection process is concluded to be "satisfactory" with the rate of 70-90%[1] (Alam et al., 2008) but there is no proper frame in place to analyze the

[1] The amount of waste collected is divided by the average amount of waste produced

processing of the collected waste. In Kathmandu, solid waste management is given low priority due to higher demands for other public services (Asian Development Bank, 2015). Despite being accorded into lower precedence, this management is consuming a large amount of the total budget of KMC (Alam et al., 2008), which leads to questioning the management in multiple layers. A satisfactory level of waste collection is not enough for a successful waste management system. The method needs to cover, the whole realm from origin to destination to processing. Ensuring effectiveness requires the definition of clear roles and legal responsibilities of institutions and government bodies which directs efficacy by avoiding controversies, ineffectiveness, and inaction (Schübeler, 1996). If each part of the system had set roles, it creates a route for accountability. Hence, it seems as though there is a lack of proper planning in the context of Kathmandu.

Activity	**Equipment in use**	**Implementation body**		
		Generator	**Municipality**	**Private sector**
Primary collection	By Hand	√		
	Handcart		√	√
	Tricycle			√
Direct collection	Tricycle			√
	Tractor			√
	Open truck		√	
Secondary collection	Tractor		√	
	Open truck		√	√
	Container carrier		√	

Table 1: Types of waste collection system, Source: KMC, 2004

Some current practices include the illegal dumping of solid waste on the river banks which have created a severe environmental and public health problem. More than 70% of the solid wastes generated are of organic origin (Asian Development Bank, 2015). Solid waste management was not a serious problem before the 1980s. The management was done jointly by the city residents and the municipalities. Solid wastes were collected and disposed of by the municipal labor force (KMC, 2008). Rather than focusing on a bottom-up approach, choosing a landfill site gets the focus and attention. However, without a plan to locally manage the high volume and percent of organic waste, landfill sites will fill up quickly, causing problems of people who live nearby. "Out of sight, out of mind" (Adam et al., 2008) phenomenon is a widespread public response to SWM problems. Thus, public discontent is a prime challenge in this system.

Figure 1: Waste piled at Teku Transfer Station, Source: Asian Development Bank, 2015

Even though the municipal system is not concentrating on locally decentralized waste management, there are private systems in place that have been helping the valley residents to get rid of non-organic wastes. There are workers hired for cheap, who go door-to-door collecting recyclables that are later used into making other products. That include shoes, metal pieces, and other by-products that are hard to manage at household levels. This informal process of waste collection has recently been formalized where the collection comes at the discretion of the public. One can have their trash pick-up scheduled, and a worker comes for pick-up at the scheduled interval. Although the door-to-door collection has been introduced in most parts of the city in partnership with the private sector, it is still not extended throughout the city ("His Majesty's Government," n.d.). This private door-to-door waste collection is a for-profit company, and with privatization, they have an advantage of product-discrimination. They can pick and choose what kind of waste they collect and process, unlike the municipal service where all trash needs to be picked up.

Another factor that also affect the city as well as the entire nation is political instability. The political unrest in Nepal affects Kathmandu on many levels. The sudden closing of streets, announcements of government offices shutdowns, forceful closures of businesses, fire on the streets as a sign of protest; they are all expected to happen at unexpected times, and this causes people to worry about daily survival and subsistence, not garbage, hygiene and sanitation.

This research hence focused on analyzing the difference in approach, planning, response and efficiencies between the municipal waste management system and the private sectors that are involved. With the different degrees of freedom that comes with the municipal service, this study attempted to seek other factors that are challenging and aiding these systems. Such factors included not only uncertainties like population burden but also the

systems in place such as plans and frequencies of pickup times and routes by area. Systems sustain because of enforcements of regulations. This study also attempted to evaluate the regulations or the lack of regulation that the systems face and analyzed whether this has an impact of the SWM operation and their performance.

3.2 Research Questions:

This research has the following objectives:

- to examine the effects and impacts of decentralization in the SWM systems in Kathmandu on the city, the people and the systems themselves,
- to evaluate the drivers of SWM system operations, and
- to analyze the efficiency of any SWM system and its operation in Kathmandu.

In order to fulfill the objectives, this research attempts to answer the following questions:

To what extents are decentralization and privatization detrimental or beneficial to the waste management systems in Kathmandu Nepal?

- How effective has public-private partnership been? How are these efficiencies measured? Is it economic or environmental?

- How is the public-private infrastructure different than the recently formalized decentralized infrastructure?

- These systems have different degrees of freedom but do these degrees of freedom apply to only systems or the people they serve as well? Could that also have led to different outcomes of these management systems?

4) Literature Review:

Performance of a solid waste management infrastructure and its drivers vary based on many factors such as technical, environmental, financial, socio-cultural, institutional and legal (Guerrero, Maas, & Hogland, 2013). Such factors differ on a place-by-place basis. For instance, in industrialized countries, public health, environment, resource scarcity, climate change, and public awareness and participation have acted as solid waste management drivers but in developing countries, urbanization, inequality, and economic growth; cultural and socio-economic aspects; policy, governance, and institutional issues; and international influences have complicated solid waste management (Marshall & Farahbakhsh, 2013). Such systems are a product of multiple facets that multiplies both physical and conceptual components (Seadon, 2010). For effective solid waste management, there need to be interdisciplinary and multisectoral considerations, along with definitions of clear roles and legal responsibilities for the interaction of manufacturing, transportation, urban growth, public health and land use patterns. (Seadon, 2010).

Conceptually, collaborations between institutions would result in an ideal and optimal waste management service. However, in its daily operation, elements such as collection, transfer, and transportation practices are influenced by improper bin collection systems, poor route planning, insufficient infrastructure, poor roads and number of vehicles for waste collection (Guerrero et al., 2013). According to Guerrero et al, the management of these services come under the municipal authorities and seemingly leading to the conception that solid waste management is to be the responsibility of local authorities. For

any solid waste infrastructure to be analyzed, three dimensions should be examined across. They are the stakeholder, the stages of movement of materials, lenses through which the system is analyzed (ibid). Stakeholders generally include national and local government, municipal authorities, city corporations, municipal authorities, non-governmental organizations, households, private contractors, municipalities, and recycling companies. The stages of movement depend on what form of management is administered in the area, decentralized, localized, centralized, and the flow from origin to disposal. The lenses of the system would be economical, socio-cultural or legal. For Kathmandu, many studies have been done in the field of solid waste management. The challenges of solid waste management in developing countries such as Nepal arise because of the burden posted on the municipal budget as a result of high costs associated with such kind of management (Guerrero et al., 2013). Generally, in a city, different waste sources scattered throughout the city in a heterogeneous way that increases waste collection and transportation cost in the waste management system (Das & Bhattacharyya, 2015). Therefore, investments should be made towards a transportation strategy that optimizes such cost.

In addition to financial feasibility, there needs to be a constant oversight and feedback process. It is not only about selecting suitable technology and equipment but also an implementation of appropriate management and oversight techniques (Dangi et al., 2017). However, there are many parameters such as waste generation rate, functioning costs of facilities and revenues in this system are associated with uncertainties (Yadav et al., 2017). Thus, the involvement of the most major stakeholder plays a vital role in working around such uncertainties: the households. The producers of waste need to have adequate information on the waste collection, where and how often. Therefore, including the public

in the decision-making process would decrease the burden and lessen the conception of municipal authority holding the sole responsibility of being a clean city (Guerrero et al., 2013).

The judgement on the effectiveness of a solid waste management system of any place relies on one fundamental question: *Is the place clean?*

Cleanliness is feature of a place that describes the success of waste management infrastructure, and yet, there is no definition given to that feature in an urban context. The measure of cleanliness is rather subjective and would vary on scale and scope, so it is justifiable as to why an attempt to describing it has not been made. Clean would mean presence of nothing. If there is nothing present visually, then that space could be termed clean. If cleanliness could be the measure of the efficiency of waste management infrastructure, it would also consider the final disposal of the waste. If so, the scope of the definition would change. From the lens of planning and development of a solid waste management system, decision makers must develop an insight into the processes that include waste generation, collection, transportation, processing, and disposal methods (Yadav et al, 2017). An unclean place leads to pollution. There has been a tendency in poorer, less educated, disadvantaged people or ethnical minorities to closer to waste treatment facilities (Martuzzi, Mitis, & Forastiere, 2010). Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. (EPA 2010).

For the purpose of this study, “clean” is defined to analyze the effectiveness of the waste management system in the area it is designed to serve. Hence, the following definition would be used to guide the study ahead.

An area is considered clean if the passers in the area i.e. pedestrians in the streets/sidewalks can freely walk about the designated walking area, without diverting from their original path due to presence of a spatial garbage hurdle (excluding trash cans or construction barriers), and without a disturbance to their breathing process due to atmospheric garbage hurdle. Any such hurdle would result in a disturbed passer.

5) Methodology:

The methodology is divided into the following parts:

5.1 Primary and secondary source analysis

To aid to the understanding of changes, implementations and effectiveness in policies related to solid waste management, the following were incorporated:

Study of the Solid Waste Management Act of 2011 and it's impacts on KMC's SWM was included.

Peer-reviewed articles on the impacts of implemented waste management regulations in Nepal were analyzed.

KMC's municipal records were investigated to examine what the city measures and how they evaluate their performances.

5.2 Direct interviews:[2]

Another method of data collection in this research was through interviews. People who are associated with the solid waste management system in Nepal in both public and private sectors were reached out. The interviewees included Ground workers, Developers, Academics and Planners. An altogether of seven interviews were collected. Some individuals worked in multiple roles. With an intent of gaining perspective on various layers of waste management organizations, interviewees on all levels of management were chosen. Interviewees were contacted via email. However, the system of emailing is not very

[2] Interview Questions attached at the appendix

widely utilized in Nepali government offices. Hence, some of my interviews were conducted by visiting government offices unannounced.

The goal of these interviews was to gather content on management systems, performance evaluation techniques, priorities of the systems and the tools used for waste collection and disposals.

The interview responses were evaluated through synthetic interpretative analysis. The study seeked similarities or differences between previous studies and the interview responses. Comparisons of information of various agencies and interviewees were made in order to examine the consistency. The inferences of interview responses to the various aspects of SWM were evaluated. The responses from various agencies were used to assess impacts in the key stakeholders of the systems. In addition this study also attempted to understand implications on urban planning processes.

6) Findings

6.1 Defining "clean"

This study sought what clean means for several actors in the system who have the authority and power in SWM. Some of the definitions that came across are as follows:

A system can contribute to clean space when it has at least a 95% efficiency in terms of collection.
Just because an SWM system has a provision of the collection, transportation, and disposal, it does not mean that the system can be useful in the context of each city. Hence, it is essential to track the generation of garbage on a local level. Instead of looking at KMC as one unit and looking at the waste generation in KMC, if the data collected could be more on a neighborhood basis, it would make collection efforts much more effective. In addition to information on waste generation, it is also important to track how much trash is collected. By comparing generation with the collection, the gap can be, and a targeted approach can then be directed.

A clean place is made possible with aware, alert and action-minded residents.
Urbanization, population densities, and crowd symbolize a growing city. The rate of waste generation increases with the growth of the city and is inevitable. There are many ways to treat waste at home, and if people were aware of such measures, there would be less waste burden for the city to deal with (a city waste worker). While it is true that citizen awareness can play a significant role in treating waste at the source, it should not just be a general expectation that if people are made aware, it will start happening. Their socio-economic status defines people's daily priorities. When there is a struggle to sustain one's family and their livelihood, awareness about garbage is not going to help in reducing waste.

Being clean means having the right system for the right place that not only aids to clean space but also ensures a healthy space with clean air, water, and other environmental aspects.

Clean is not just about proper solid waste management. It is not merely visual clarity on the streets. If the waste collected from households are deposited into riverbanks, then it is defying the idea of this clean city. A city consists of multiple functioning elements. There needs to harmony between them.

6.2 Collection Methods:

The private sector performs in many ways that vary in terms of service as well as scale. There are operators who serve certain neighborhoods and their operational cost is sustained through the payments by people in those neighborhoods. Most of these companies do not have a contractual agreement with the city[3]. There is an agreement between the service provider (private companies) and the beneficiaries (local people) because of which the monetary exchange is ensured but there is no regulation that the city has in terms of their operation. Then there are other companies who have based their business around the idea of recycling. Instead of collecting money from the people, these companies offer a rate to buy people's recyclables instead. They serve a wider area. According to a private SWM planner, organizations like these employ *Kabadiwaalaas* (term used to describe people who used to go door-to-door in search of recyclable waste). Such platforms have not only gave a formal employment to the informal group of *Kabadiwaalaas* but also gave people an option to create capital out of their recyclable waste. The

[3] About 4-5 private companies run with a contractual agreement out of 36(estimated). KMC records, 2019

operational sustenance of these companies is through a transaction of the collected recyclable waste to the industries that buy them as raw materials. Most of these companies operate as a business so they are registered and are bound with some contractual form. Other types of private companies serve specific clients instead of neighborhoods. These companies are either hired or are partnered with for a certain time period.

The Solid Waste Management Act 2011 (Chapter 2, Part 7.1, page 7) states that: "The time, place and manner for discharge of solid waste shall be as determined by the local body." The regulation in KMC per this rule has been made. Legally, all waste should be collected by 9am. KMC sends its collection vehicles through the neighborhoods and people are expected to come and drop their waste into these garbage trucks. These collections are not done daily. This presents a challenge, especially for working class. It is not possible for everyone to make the disposal at the designated time. Therefore, if a household misses its disposal in the morning, it is highly probable that they wouldn't be able to make a disposal for few more days.

There are about sixty-five vehicles of varied sizes that go around KMC to collect garbage every day. Residential areas are not checked every day but there are some areas that do get scanned for collection each day. The waste collection party termed such places "important". These places mostly included areas that habitat high government officials and large hotels where international political guests tend to stay. The collection vehicle operators get manual instructions about their route and timing every week. Their shifts are rotated around on a weekly basis as well. Although the collection/ cleaning is designated to be done by 9am, there are a few flexibilities to this rule. According to a ground worker, then

visits from international political powers are expected, there are orders to get the city extra clean.

One of the amenities that people look for in a place of dwelling is the place to dispose their trash. Apartment complexes have trash chutes. Classrooms and parks restrooms have trash cans. However, streets of Kathmandu lack that amenity. The threat of terrorism and potential of such attacks caused the city to pull out all trash cans out of the streets. While the threat of attacks is a rather valid reason behind the removal of trash cans, KMC had recently installed trash bins in the city. These bins were placed on the streets between Maitighar and Baneshwor, which are rather prominent places. The city had 60 bins with plans to install them in other prominent places around KMC. These bins however serve more of a purpose than merely collecting trash. They have separate section of perishable and non-perishable waste. They are called "smart bins" because they are charged with solar power and possess charging ports for mobile phones. They display pollution and temperature level of the surrounding as well, and majorly these bins cost NRS 600,000 (USD 6000) each. It is important to note that these bins also have another feature; a space of displaying advertisements. This project is a result of a public private partnership between KMC and a private company called Krishna Suppliers.

6.3 Transportation and Disposal:

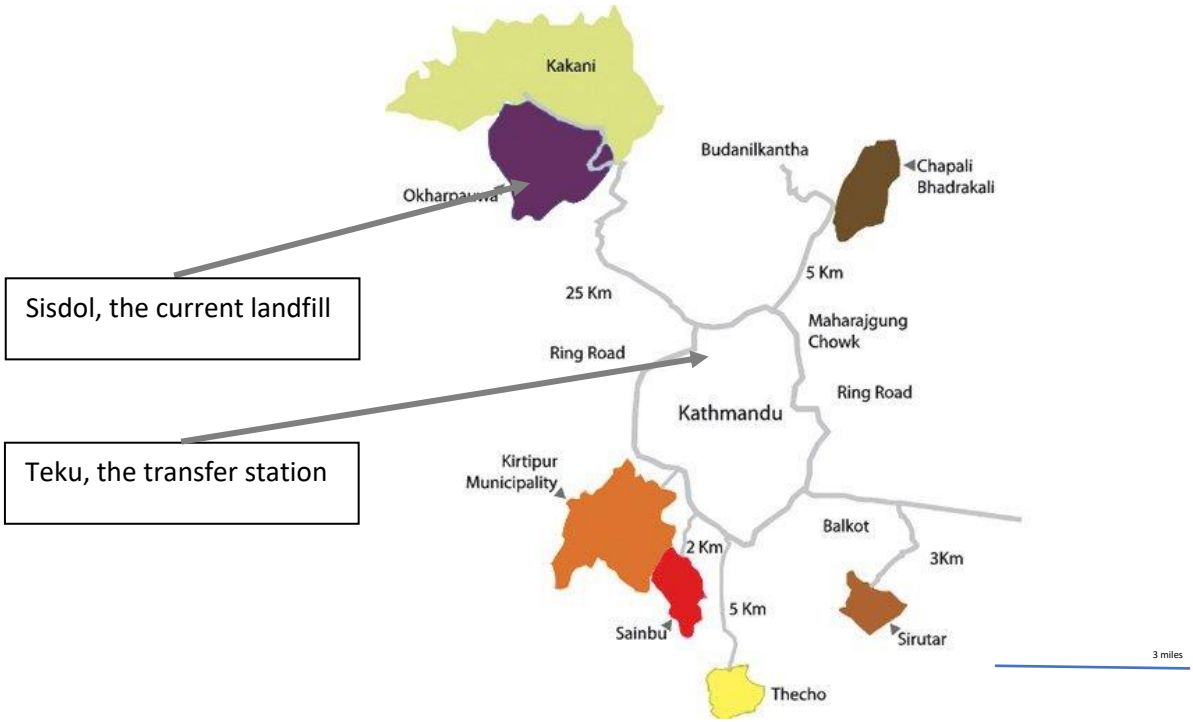

Figure 2: Reference Map: Kathmandu to Sisdol ("Working Areas | BSC - For Empowerment," n.d.)

There are two phases of transportation in KMC's SWM process. First part accompanies collection from the source to the transfer station at Teku. Then, another part is the final disposal to the landfill site at Sisdol. Private companies have a somewhat different approach on transportation because this process is defined by what the method of final disposal is. The landfill site is under the authority of KMC. However, there is no treatment facility the final disposal of waste by private companies is not transparent. Although the collection process is divided for the different operators, it seems that they come together when it comes to disposal. Most of the garbage and waste end up in the river banks. According to KMC waste worker, "The disposal in Kathmandu's river is the easiest for

private companies. It saves them time and cost". There are some private companies that do claim to work towards sustainable solid waste management. To the general public, these organizations market themselves by emphasizing on reducing, reusing and recycling waste. While this does seem like a noble approach towards waste management, there is no transparency from their side about what happens with the residue that could neither be reused not recycled.

The final disposal part of this KMC's SWM adds more players in this arrangement. The presence of landfill is not something that any local body seeks in their locality. The landfill site was originally designed for a three-year operation, that should have been concluded in 2006. However, it has been thirteen years and the same landfill site is still being used. For this operation in Sisdol, the KMC gives 10 million NRS (approx. 100,000 USD) to Sisdol as a form on compensation to allow this landfill site on their land. In addition to the destination itself, there are many villages that fall on the route and these areas also bear the consequences of the waste disposal.

The transportation of waste disposal has some other downfalls as well. The employees under the city have job security. According to a city employee, they have formal titles as government employees, and the city would compensate for any form of accidents that occur during the process of waste work. Many of the workers who assist the private companies that are not regulated by the city are working at their risks. There is no insurance for accidents that they could endure. Hence, lack of regulation from the city allowing the private companies to gather desperate employees who would not negotiate for more than whatever little income they get offered.

6.4 Measuring Efficiencies

All the SWM systems in operations have different approaches to measuring their efficiencies. KMC tries to work under the allocated budget. In terms of economic perspective, they keep track of their spending and come up with routes that are optimal in terms of fuel efficiency. They seek to cover as much ground with as little fuel as possible and collect as much garbage in as little trips as possible. When vehicles report to the transfer station after their collection, the information about the loads that each truck brings is recorded, which includes the time when the vehicle started picking up, the time when the vehicle arrived at the transfer station and the amount of load that each vehicle brought. The data log is collected through paper vouchers.

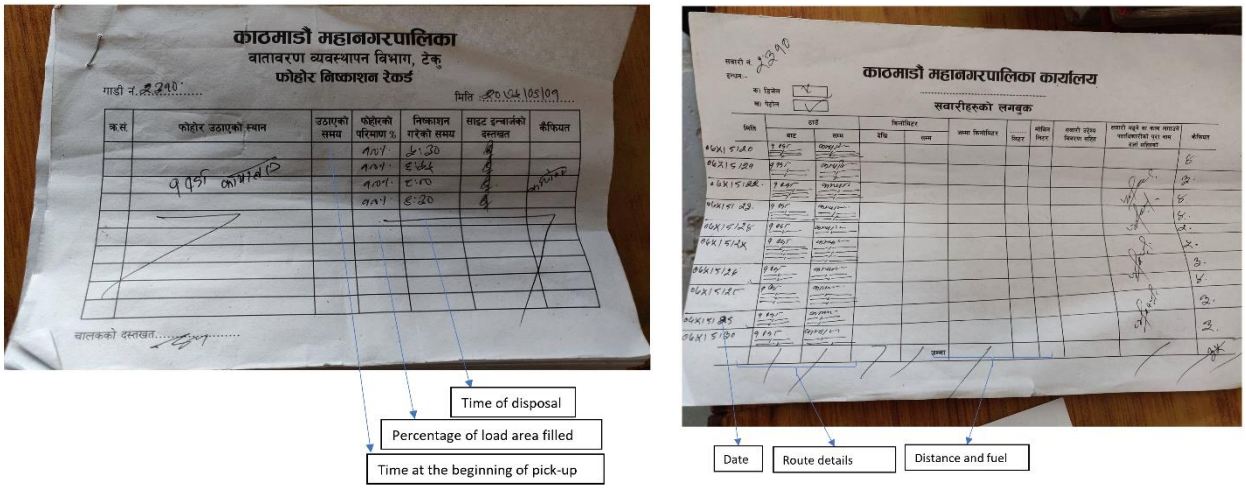

Figure 3: Trip and Vehicular log at KMC office

Another log that is recorded is on each vehicle that is taking part in the process of collection. This record consists of the route that the vehicle took in any particular day, the distance travelled, and the amount of fuel used.

The efficiencies of private sector are driven by the goal of sustenance of their operation (Private SWM planner). If a business is operating well i.e. generating revenue, then it sustains. For any SWM business to operate, they need to serve the purpose that they were created for which is to clean the neighborhoods. Without this part accomplished, there is no reason for the people to pay the private sector if they cannot deliver (ibid). Thus, efficiency for these companies would be defined by customer satisfaction and continued income.

Outside of the efficiency measure of the systems in KMC, there is another measure in Nepal on cleanliness. There have been awards for and studies about clean municipalities in Nepal. The Solid Waste Management Technical Center (SWMTC) handed monetary awards to the cleanest cities. According to SWMTC, the awards are given for the "efforts in solid waste management, proper drainage and sewerage system, greenery and beautification, and clean environment". The awards were given to Waling Municipality in 2016 and Dhankuta Municipality in 2017. The guidelines and standards against which these judgements are made, and the awards are given is not clear.

6.5 Potential of growth

With the aim of combatting the waste management challenge in KMC, there was a grant for implementation of an integrated solid waste management system (ISWM) in Kathmandu. This project is designed as a special purpose vehicle that'd operate for about two decades and hand the responsibility back to KMC. The ISWM got its RFP in 2010. The system should have been in operation for six years in 2019, but since a development agreement has not been signed, this system has not been put in place. A major deterrent for this project is the severity of the

political unrest in Nepal over the past decade. This project was a decision of central government agencies like Investment Board Nepal (IBN). So, it requires a higher approval for any changes or any development regarding the project. The implementation of the project is local, i.e. in Kathmandu city, but the sanction needs to come from a non-local governmental body. The change in government leaders due to the political instability pauses central procedures. Thus, the political turbulence and the persistent change of government has majorly hindered the progress of ISWM, which was an initiative towards better management of waste in Kathmandu.

7) Discussions:

7.1 Collection methods

Street litter, piles of garbage on the street corner and turns are a common sight in Kathmandu. If people had a place to dump their waste somewhere then perhaps, there would be a reduction in street litter. The lack of trash cans could be a reason why street litter is a significant challenge. However, according to the city's waste workers, "When there were dustbins placed, people would not throw their garbage in the bins. There was reckless disposal of garbage, so lack of trash bins is not the cause". The placement or hence the lack of trash bins might not be the sole cause of littering. The use of such amenity and the way of using them does depend on social culture but just because trash was present around the designated bucket does not defy the purpose of its placement. "One cannot expect people to throw trash just inside the bins. By putting the bins, we need to accept the fact that we have to clean around the bin too" (a planning consultant).

While the threat of attack was a reasonable motive to remove trash bins out of streets in KMC, the implementation of "smart bins" suggest that the city has decided to overcome such fear. The cost of these bins (USD 6000 each) is immense and do invite questions. The city does not have an explanation or transparency about their decision on choosing the locations for placement of the bins. They are charged with solar power and possess charging ports for mobile phones. These bins display pollution and temperature level of the surrounding as well. It is important to note that these bins also have another feature: a space of displaying advertisements. Businesses want to place advertisements at places where they can get a large audience. Thus, places with more crowd mean more exposure. This has two sides. It is reasonable to assume that more substantial number of people would lead to the production of

the more substantial amount of trash, so having advertisements in the trash cans probably is a creative solution that benefits the collection process, the company that installed the bins, and the businesses that would display their advertisements.

On the other hand, it is important to question this assumption, the amenities that these bins present and the usage-placement process. There have been demands of trash bins by local people. The demands were for 200 places (a planning consultant). The process of the placement selection is not transparent to the local, and it is unclear to what advantage is the massive expense for something as simple as a trash bin is providing. If the investment was for data collection on pollution, there is a lack of transparency on who is using these data. These limited placements are also not enough to understand KMC's pollution. If the goal was to give people a proper place for waste disposal and the give waste workers a proper place of waste collection, no study was done to ensure that these places were indeed the ones that needed the bins most.

Lack of garbage collection containers does make the process of door-to-door collection challenging for the city. Since people might not have a place to keep their waste at the house, KMC falls victim to indiscriminate disposal of waste (Waste Worker). Although residential areas do not get served every day, the "important" places are scanned every day. These places mostly include areas that habitat high government officials and large hotels where international political guests tend to stay. These areas get special attention. There is a certain relationship to these "important" places and the way they are prioritized in other ways. These areas are, again, the "important" areas and also the prominent streets that include the airports and incidentally, also many of the locations where the city decided to install their "smart bins." Thus, it is essential to consider the level of service that the collection process is providing. The

household wastes contribute to a high amount of solid waste in Kathmandu (ADB, 2013) but the attention is not focused on households by the city. The garbage collection cut-off at 9 am challenges the local and instead of implementing bins on residential areas where people could drop their trash as per their convenience, the city is supporting the implementation of expensive bins that is focused around technology that is not serving the public with their needs. People's demands were not considered in this decision.

7.2 Accountability and losses

There are about 35 private groups that contribute to SWM in KMC. These groups work on a smaller scale compared to KMC's SWM system. They look over the collection and disposal of waste from a cluster of localities. Some amount of fees (approx. $400/ month) is collected from the households in the areas, and in turn, the private companies collect and dispose of their garbage. There is no operational contract between the private agencies and KMC, which means that KMC's central waste management system is merely one of the many operators of SWM systems in the city. The lack of any form of a contractual obligation between private agencies and the city raises questions of accountability. Accountability for both KMC and the private agencies play out differently, mainly because of how they operate. The operational cost of KMC's SWM is through the municipal budget. The accountability here is to the people through their elected officials. However, the height of political instability and lack of representation from people hampered KMC's accountability to the people in the city. This affirms the study done by Dangi et al in terms of the lack of constant oversight.

On the other hand, private agencies are paid by the people/ residents of the area to have their space clean, which makes them accountable to do their job well if they aim at continuing the venture. The private agencies, however, have no obligation to answer the city. These agencies

are benefitting from their collection systems, and their profit comes from the extra capital that people are investing in a service that the city should have been providing them. The decentralization of waste collection and waste management system through the emergence of the private sector might seem as an overstep into the city's jurisdiction, but the city instead seems to be benefiting in some way. The responsibility of a cleaning Kathmandu is shared with no cost to the city. The only monetary loss is being bearded by the public who are paying the private agencies for gaining a service that their taxes already have paid. Hence, in this system, the actor that experiences the loss is to the people in the community.

Another loss is for the employees of some private companies who are exploiting their workers. These companies have no legal obligation towards the city, their employees or their customers (a private planning consultant). The operations are running out of desperate need and the city's inadequacy to serve its jurisdiction (an environmental planning consultant).

7.2.1 Disposal process and KMC's role

KMC is not acting as a regulator in the current SWM dynamic of the city, and lack of accountability has led the city further down in terms of sanitation and cleanliness. The presence of this landfill is highly valuable to KMC and the fact that this site has been overused for an extension of ten years than the initially predicted and promised time is proof of that. According to a waste worker, this desperate need of KMC and the lack of any other option in terms of waste disposal has its downside that advantages are being taken by all those who can threaten the disposal process."- Waste worker. One of such instances include "money extortion or call for demand negotiations. There is a village named Kagatigaun that lies on the way to Sisdol from Kathmandu. This area has many farmers who come to the outskirts of Kathmandu to sell their products. The transaction of vegetables on the streets is a common and ordinary

scene in Kathmandu. The villagers from Kagatigaun come to the outskirts of Kathmandu at Balaju Bypass for their sales. The vegetable carts placed on the streets resulted in narrow spacing for vehicles to pass which resulted in an accident. When the vegetable dealers (villagers from Kagatigaun) were held in custody by KMC police, the garbage trucks were stopped at Kagatigaun with a demand for settlement and the release of their people. From one perspective, it could be viewed as unethical. For a ground worker who is doing their job (of transporting the waste to the landfill and dumping it into the landfill), this act causes a direct unfair impact. However, on a broader perspective, it is important to note that while Sisdol (where the landfill is) is compensated monetarily, the villages that contribute on the route are not. Despite the environmental and socioeconomic impacts that these villages face, no compensation is provided to these areas. KMC is the metropolitan capital of the country and priorities seem to be given to the economically powerful city from a national level. The mere overuse of the landfill sites is enough to suggest environmental injustice in places like Sisdol. There is not agency in place to examine the health hazards that people in the community are being exposed to. Thus, the disposal process not only calls for attention from the city in terms of management but also is an active cry for environmental justice.

Figure 4: Collection Vehicle at the Teku Transfer station

Hence, it is not surprising that they are using their leverage to benefit their community.

KMC has no contingency plan that is an alternative to the landfill disposals. Hence, the city has been agreeing to whatever terms the sites have so that the city can keep taking the trash to the landfills (a planning consultant). The disposal is not just challenging for KMC's SWM system but also to the private waste management companies. Apart from the companies that deal with recyclables (who have vendors to deal with their collected trash), the disposal process is not transparent. Most of the disposal is believed to have been made in river banks. While this is a rather severe environmental hazard to the people and the city, and illegal, KMC is not able to use its authority to punish the wrongdoers (a private SWM consultant). "If KMC challenges,

private companies in their process and sues them, there will be a decline in private companies stepping up for collection." (ibid). Since the private companies are sharing the collection responsibility of KMC with no additional cost to the city (just the people), it is likely that KMC does not want to risk this system.

7.2.2 Potential growth and the challenges

Many sectors in Nepal suffer from the downsides of bureaucracy and SWM systems are not immune either. In addition to the challenges of bureaucracy, the political instability of Nepal in the last decade has aided in worsening the situation of SWM and in hindering possible progress. With the aim of combatting the waste management challenge in KMC, the plan of ISWM was issued for Kathmandu. This project was a decision of central government agencies like Investment Board Nepal (IBN). Despite the RFP in 2011, this project is still not implemented. Many planning consultants claim that SWM suffers from enormous institutional incompetence and lack of coordination. The implementation of this ISWM was intended for KMC, but it falls under the authority of central government, instead of the city. This adds the level of dependencies and has slowed down the process. "The central government took on the responsibility of local government, and it is causing problems for this initiation." (an environmental planning consultant). Perhaps, the involvement of the central government is a reason behind the delays that this project is facing, but there is no reason to believe that KMC would have performed better in this regard.

Before this project, KMC has had multiple foreign aids from countries like Germany and Japan. Most of the aids are towards the advancement of SWM technologies. These foreign aids have not been noticeably impactful towards the progress of the SWM system in KMC. Despite the decade's foreign aid, there was a lack of adequate services which led to the return of riverbank

waste disposal by 1994 (Dangi et al., 2014). The German aid was reported to be too technical, undermining local capacity and burdening the city with a second waste disposal institution (ibid). The aids from India lacked focus and follow up programs and encumbered a developing country with outdated equipment that did not meet the local needs while the Japanese aid depended on wrong assumptions, stressing costly landfilling that employed heavy machinery and upgraded equipment inappropriate for local conditions (ibid). The data collection process, training process and overall operational process of KMC's SWM are very manual. Data logs are recorded in sheets of paper and then archived. The operation of any advanced technology requires proper training, and even before that, there needs to be a feasibility study of the targeted implementation. The technologies on the ground need to be operated by people on the ground, and hence they should get proper training for such operations. "Most of the foreign technologies are hard for us to understand because we do not have adequate training." – A waste worker. This lack of training is not because foreign assistance did not provide it. Representatives from the city are invited to get trained on the use of the materials outside of Nepal so that they could witness the functioning model. However, the pieces of training do not quite make it to the level of ground workers (a member of the grounds team). The planned multi-million investment in ISWM is the first of its kind in Nepal, and if it succeeds, it would be the first success too.

The bureaucratic system can be blamed for ISWM, but it does not seem to be the only reason. According to the original plan, this project should have been six years into operation. Adversely, the current status in its implementation is further set back with questions on how to manage the current waste workers that the system employs. This suggests that this process is facing not only the effects of severe political unrest but also a lack of a comprehensive

feasibility study, which is a rather important part of any project. The processes for any hydropower project in Nepal are comparatively lot quicker in terms of approval and implementation. This might be the result of decades of experience and expertise in the matter (a private SWM consultant). Since ISWM has never been implemented in such a large scale, the level of investment does possess high expectation from all sides (a planning consultant).

7.3 Measuring efficiencies

According to Guerrera et al., any SWM system should be examined through three dimensions: stakeholders, stages of movements and the lenses through which the system is analyzed; in order to get an accurate analysis. Hence, it is rather important to discuss how the efficiencies of the SWM systems are being measured in KMC. All the systems in operations have different approaches to measuring their efficiencies.

According to the findings, KMC tries to work under the allocated budget. In terms of economic perspective, they keep track of their spending and come up with routes that are optimal in terms of fuel efficiency which allows them to cover as much ground with as little fuel as possible and collect as much garbage in as little trips as possible. The logs are made for each vehicle as well as each trip to the landfill. Economic efficiency is a part of the city's goal, and hence they log their fuel expenditure. There is data collection on what percent of the carrying capacity utilized, but there is no data on what percentage of the locally disposed of trash was collected. No system records the amount of garbage that the neighborhoods produce. The lack of information on which neighborhoods are the high contributors to solid waste means that there is a lack of needs assessment. Thus, the city does not have enough information to address issues of different neighborhoods. If economic feasibility is the prime goal for KMC, then this is

an unjust treatment and lack of attention to the risks that lack of proper SWM is leading the city towards. However, if the prime goal is to strive towards better performance, then the measurement of performance should be taken to address the issues at hand. Management thinker Peter Drucker is often quoted saying that one cannot manage what one cannot measure. Thus, if there is not measurement being done on how garbage production is changing, the city cannot track it and therefore would not be able to adapt to the changing needs.

SWMTC hands monetary awards to the cleanest cities (out of 58 municipalities) in Nepal. Waling Municipality in 2016 and Dhankuta Municipality in 2017 received the awards. The guidelines and standards against which these judgments are made, and the awards are given is not clear. As per the award, these municipalities are exemplary in terms of how their SWM systems operate. However, Waling does not have a sanitary landfill site in place, so the final disposal here takes place in riverbanks (ADB, 2013). Dhakuta, on the other hand, uses its landfill for the final disposal (ADB, 2013). Bhaktapur is also another municipality that is considered having one of the best practices of SWM in Nepal (PAN, EU 2008). Incidentally, one of the major disposal processes in Bhaktapur also includes open riverside dumping. There is no set standard that municipalities can follow towards a vision for cleanliness. The goal of a solid waste management system is to keep any space clean. However, the definition of "clean" is a rather unclear territory. Among a list of multiple definitions that the Solid Waste Management Act of 2011 in Nepal put forth, it did not define clean either. If the municipalities that use riverside dumping as their method of final disposal, are getting awarded the title of cleanest cities, then it is obvious that the lenses for the analyzing SWM systems do not consider environmental impacts. The "out of sight, out of mind" mentality applied to landfill sites but if the waste disposal is being done openly at riversides in the city, it is not "out of sight." The lack of environmental approach in assessing SWM systems is not sustainable since it is only

addressing the immediate visibility and immediate impact. The absence of sustainable measure in the city is also reflected in local behavior. People “burn their garbage to clean it” (private SWM consultant). Therefore, the efficiency of a system is not just about how well is waste leaving the place of its origin but also about where is the waste ending up.

8) Conclusions and recommendations

The rise of private sector and the decentralization of SWM systems in Kathmandu occurred to fulfill a gap of demand and supply. With the rapid growth of population in Kathmandu, the pressure on existing infrastructures are ever increasing and SWM systems are facing that pressure as well. People who can afford to pay for a private service to clean their neighborhood get cleaner dwelling areas. Waste from other ill-attended areas end up haphazardly on streets. Street litter is not the only SWM challenge of Kathmandu. Most of the waste materials get deposited on river banks as well. This method of disposal is incorporated by many private companies and the city is shying away from intervening on such behavior. The city is only acting as one of many SWM operators in KMC. If the role of the city could be more of a regulator then holding the companies accountable would be feasible.

In order to get to the place of a regulator, the city needs to improve the SWM operational processes. For the improvement to occur, the city needs to be able to measure where the gaps are. The current methods of data collection do not reflect adequate information that is needed to address the issues on a deeper level. The instructions for service are based on the routes that vehicles travel. This information is vital in understanding which areas are demanding more service. The information collected currently, reflect the carrying capacity of the truck and the load that it delivers. However, if with every collection, the information on how much waste was left abandoned and the cause of abandonment were noted as well, then this could direct the city's attention in understanding the challenges that different areas in the city face. Perhaps some areas need smaller vehicles or compressing containers,

whereas some places might have the need for larger trucks. Collection of such data will also help track the improvement of the SWM service through the rate of change in abandoned waste.

The requirement of all waste being collected by 9am seems to be causing more problems. Municipalities like Bhaktapur have larger collection at least once or twice a day, depending upon the neighborhood and have implemented a system of neighborhood level municipal labor who sweep the floors at least four times a day (PAN EU, 2008). Bhaktapur collects funds from local households to carry out this process. In KMC, there are households that pay private companies, so households are willing to allocate fund for cleaner community. If the city could regulate these companies and get revenue from them for their eligibility to run as a business, the city could invest those money in places where people cannot afford to pay private companies. This is not a sustainable plan but with optimal feedback, and performance tracking, the city can help regulate services as per the neighborhood's needs. The three phases of SWM system could be operated by different parties. The presence of private sector that handles recyclables could have collaboration with the city. If the city is The designated final disposal site for KMC is a sanitary landfill site about 24km away from the city. This facility is ten years past its original operational contract, so the "sanitary" part of this landfill site is meaningless. The city compensates Sisdol (the landfill site) for the inconvenience that the landfill causes. However, there is little action being driven to work towards an alternative of landfill. This just means that the waste, the unwanted materials from one place is being dumped into another. Even if Kathmandu could be the cleanest place with optimal collection methods of waste every day, the lack of accountability in the disposal part of the SWM system is a large negative on the evaluation on the system. The

planning for ISWM does have a higher emphasis on use of advanced technology for waste treatment rather than mere disposal but this program also has a provision for a landfill construction. If the landfill is constructed then, it should only be used as a last option to dispose of only those waste that couldn't be treated.

Bibliography:

Offenhuber, Dietmar, and Carlo Ratti. Waste Is Information: Infrastructure Legibility and Governance. The MIT Press, 2017.

Alam, R., Chowdhury, M. A. I., Hasan, G. M. J., Karanjit, B., & Shrestha, L. R. (2008). Generation, storage, collection and transportation of municipal solid waste – A case study in the city of Kathmandu, capital of Nepal. Waste Management, 28(6), 1088–1097. https://doi.org/10.1016/j.wasman.2006.12.024

Asian Development Bank. (2013). Solid waste management in Nepal: current status and policy recommendations. Retrieved from http://site.ebrary.com/id/10900904

Dangi, M. B. (2009). Solid waste management in Kathmandu, Nepal: The anatomy of persistent failure (Ph.D.). The Johns Hopkins University, United States -- Maryland. Retrieved from http://search.proquest.com/docview/304902655/abstract/14F55CDBF6FF4220PQ/1

Dangi, M. B., Cohen, R. R. H., Urynowicz, M. A., & Poudyal, K. N. (2009). Report: Searching for a way to sustainability: technical and policy analyses of solid waste issues in Kathmandu. Waste Management & Research, 27(3), 295–301. https://doi.org/10.1177/0734242X08094951

Dangi, M. B., Fernandez, D., Bom, U. B., Belbase, S., & Kaphle, R. (2015). Evaluation of environmental impact assessment report preparation and public participation in landfill projects in Nepal. Habitat International, 46, 72–81. https://doi.org/10.1016/j.habitatint.2014.10.021

Dangi, M. B., Pretz, C. R., Urynowicz, M. A., Gerow, K. G., & Reddy, J. M. (2011). Municipal solid waste generation in Kathmandu, Nepal. Journal of Environmental Management, 92(1), 240–249. https://doi.org/10.1016/j.jenvman.2010.09.005

Dangi, M. B., Schoenberger, E., & Boland, J. J. (2015). Foreign aid in waste management: A case of Kathmandu, Nepal. Habitat International, 49, 393–402. https://doi.org/10.1016/j.habitatint.2015.06.010

Dangi, M. B., Schoenberger, E., & Boland, J. J. (2017). Assessment of environmental policy implementation in solid waste management in Kathmandu, Nepal. Waste Management & Research, 35(6), 618–626. https://doi.org/10.1177/0734242X17699683

Dangi, M. B., Urynowicz, M. A., & Belbase, S. (2013). Characterization, generation, and management of household solid waste in Tulsipur, Nepal. Habitat International, 40, 65–72. https://doi.org/10.1016/j.habitatint.2013.02.005

Das, S., & Bhattacharyya, B. K. (2015). Optimization of municipal solid waste collection and transportation routes. Waste Management, 43, 9–18. https://doi.org/10.1016/j.wasman.2015.06.033

Devkota, D. C., & Watanabe, K. (n.d.). NEED OF COMMUNITY BASED SUSTAINABLE APPROACH FOR SOLID WASTE MANAGEMENT IN KATHMANDU, 7.

Enviroment Audit 2071_1434876762.pdf. (n.d.). Retrieved from http://oagnep.gov.np/old/downloadfile/Enviroment%20Audit%202071_1434876762.pdf

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. Waste Management, 33(1), 220–232. https://doi.org/10.1016/j.wasman.2012.09.008

His Majesty's Government. (n.d.). Solid Waste Management, 19.

Karki, M. (2015). Towards Reaching Sustainable Urban Development in the Kathmandu Valley of Nepal: An Economic Analysis of Solid Waste Management, Recycling, and the Health Impacts of Air Pollution (Ph.D.). The University of New Mexico, United States -- New Mexico. Retrieved from http://search.proquest.com/docview/1707358038/abstract/380F2668092341E7PQ/1

KMC, 2004. Personal communication and different unpublished report of KMC on solid waste management.

Marshall, R. E., & Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. Waste Management, 33(4), 988–1003. https://doi.org/10.1016/j.wasman.2012.12.023

Martuzzi, M., Mitis, F., & Forastiere, F. (2010). Inequalities, inequities, environmental justice in waste management and health. *European Journal of Public Health*, *20*(1), 21–26. https://doi.org/10.1093/eurpub/ckp216

Miedziński, M. (2018). Do policy makers tell good stories? Towards a multi-layered framework for mapping and analysing policy narratives embracing futures. Futures, 101, 10–25. https://doi.org/10.1016/j.futures.2018.05.003

PAN and EU Aid (2008). Best Practices on Solid Waste of Nepalese Cities.

Pokhrel, D., & Viraraghavan, T. (2005). Municipal solid waste management in Nepal: practices and challenges. Waste Management, 25(5), 555–562. https://doi.org/10.1016/j.wasman.2005.01.020

Seadon, J.K., 2010. Sustainable waste management systems. Journal of Cleaner Production 18 (16–17), 1639–1651

Schübeler, P., 1996. Conceptual framework for municipal solid waste management in low-income countries. In: Wehrle, K., Christen, J. (Eds.), St. Gallen Switzerland: UNDP/UNCHS/World Bank/SDC Collaborative Programme on Municipal Solid Waste Management in Low-Income Countries.

Seeing cities through big data. (2016). New York, NY: Springer Science+Business Media.

Shrestha, R. M. (n.d.). Solid waste management in Kathmandu and Compost Practices, 5.

Singh, R. K., Yabar, H., Mizunoya, T., Higano, Y., & Rakwal, R. (2014). Potential Benefits of Introducing Integrated Solid Waste Management Approach in Developing Countries: A Case Study in Kathmandu City. Journal of Sustainable Development, 7(6). https://doi.org/10.5539/jsd.v7n6p70

Thapa, G. B. (1998). Lessons learned from solid waste management in Kathmandu, Nepal. Habitat International, 22(2), 97–114. https://doi.org/10.1016/S0197-3975(97)00030-1

The garbage capital of Nepal | world | Hindustan Times. (n.d.). Retrieved October 9, 2018, from https://www.hindustantimes.com/world/the-garbage-capital-of-nepal/story-Cyo1BfHag7NS4TwZGDHTAL.html

Yadav, V., Bhurjee, A. K., Karmakar, S., & Dikshit, A. K. (2017). A facility location model for municipal solid waste management system under uncertain environment. Science of The Total Environment, 603–604, 760–771. https://doi.org/10.1016/j.scitotenv.2017.02.207

Appendix: Interview Questions

For managerial authorities, my questions would be:

- What is the budget allocated for solid waste management? Do they go under budget/over budget? Why?
- How is it ensured that every part of the city is covered?
- Some areas in the city produce more garbage than other. How is a uniform/just management handled here?
- What has been the biggest challenge in the waste management? What about the foreign aids, how have they been helpful/not?
- The first PPP was seen with Kasturi Traders. What were the reasons for this fall out and, how is the new collaboration with Nepwaste any different?
- 65% of the waste collected is organic waste. How has the presence of local organizations like WEPCO (Women in Environmental Protection Committee) impacted this waste production?
- Is there a system in place that is used to inform household in terms of pick-up days? Do you assign different days for different types of trash collection? Would that encourage segregation of different types of waste?

(for private waste collection companies):

- Through the data collection from Nepal waste map, it is seen that the collection system is irregular. What factors do you consider deciding which areas to prioritize?
- Are there instances when you are not able to serve an area despite of collection plans? If so, what reasons lead to such instances?
- Are the wards allocated to your company travel-efficient?
- How would you define clean?

For academics/researchers:

- What do you think is the biggest weakness of the solid management system in the capital?
- What, if any, changes have you witnessed in the management in recent (5) years?
- How has the introduction of public private partnership in the SWM service aided in the management?

For ground workers:
(private vs public)

- How often is waste collected in the area?
- How is the deposit of waste done?
- What areas area hard/easy in terms of collection?
- Since a lot of waste accumulates in …. area, does waste get picked up ad dropped? Is the challenge lack of enough space in garbage trucks for all this garbage? Not enough frequency of pickups?
- How is the frequency of pickups decided?
- How would you define clean?
- For the now digitally restructured private door-to-door system:

- Have you done any assessments on how the efficiency and impact of this "Kabaadiwaala" collection system has changed before and after the restructuring?
- How many kabaadiwalas do you employ? Have you taken in all the informal workers from the previous system?
- Were there any policy hurdles to implementing this restructuring? Apart from policy hurdles, how did you "engage? /consult? partner? deal?" with the previous Asystem in place?
- You've (the company) promoted recycling as the key value for this restructuring, which is true. This plan in place existed before. You've added a digital value to this. People can schedule their pickups. How has this system been beneficial to the workers?
- Is the system solely based on the people's discretion of calling/online-scheduling a pick-up now? How is it different/like the old system?
- You've also aimed at making Kathmandu, and possibly Nepal a zero-waste place. DO you have any infrastructure in place or in planning to address organic waste?
- Do you have a deployment strategy of pickups? When you get pickups scheduled, how do you plan a time/energy efficient route for pickups?

- How would you define clean?